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Towards a powerful knowledge-based system to think outside the box and select multi-purpose plants

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Inspired by the results of the european ADAPPT (2017) and OPTIONs (2017) projects, our work aims to partially or totally replace synthetic pesticides and antibiotics using natural plant-based substances.

Knowledge on plant uses is compartmentalized according to domains, e.g. cosmetics, bioenergy, crop protection, public health and insect vectors, animal health, human health and traditional medicine.This disciplinary separation make it difficult to identify multi-purpose species which, in our hypothesis, would induce the development of new value chains.

With increasing international trade and climate change, invasive alien species is also a concern. Knowledge about their management using plants in their region of origin is not readily available for newly invaded continents.

Establishing a powerful knowledge-based system easily accessible to users with different needs, from a Knowledge Base built on multiple-purpose plants, is the answer we are developing.

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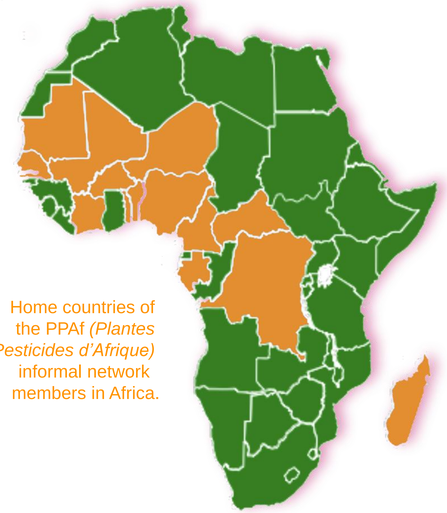
Material and Methods

- Several tabs have been designed in a single Microsoft Excel® file. Each tab contains a thematic matrix. Each theme is a plant use in a particular domain, i.e. plant and animal health, dye plants, service plants including cover crops, biofuel plants, plants for paralyzing fish, etc.
- Dictionaries allow to correct input errors (typing errors, synonyms, etc.) of the thematic tabs.
- Additional tabs describe trophic chains between organisms.
- For each matrix, the binomial plant names are placed in the first column. The next columns contain the associated attributes extracted from the bibliographical consultations.
- The search in reference databases, such as Web of Science, was performed using the keywords "pesticidal plants" and "Africa". To provide references not reported in the "classic" reference databases (Google Scholar, Scopus, etc.), the members of the informal French-speaking network PPAf (*Plantes Pesticides d'Afrique*), set up in 2015, were interviewed.
- A complementary approach was taken by particular topics, such as plants grown in organic farming, by sector (cocoa, cotton), or particular pests such as ticks or invasive alien species, such as the insects *Spodoptera frugiperda* or *Tuta absoluta*.



Home countries of the PPAf *(Plantes Pesticides d'Afrique)* informal network members in Africa.

Results

- In April 2021, the “plant, animal and human health tab” gathered 2543 species of plants.
- At the current stage of the data entry, a comparison between the uses inserted in the different tabs makes it possible to identify the plants reported for at least four (4) different uses.

Excerpt of the Knowledge base:
plants mentioned for at least 4 uses.

Plant species	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Allium cepa	x		x	x		x	
Anacardium occidentale	x		x	x		x	
Annona muricata	x		x	x			x
Balanites aegyptiaca			x	x	x		x
Brassica rapa	x		x	x			
Carica papaya	x		x	x			x
Cocos nucifera	x	x		x		x	
Curcuma longa	x		x	x		x	
Helianthus annuus	x	x		x		x	
Jatropha curcas		x	x	x			x
Laurus nobilis	x		x	x		x	
Mangifera indica	x		x	x		x	
Momordica charantia	x		x	x			x
Parkia biglobosa	x		x	x			x
Ricinus communis	x	x	x	x			
Trichilia emetica			x	x	x		x

Legends of uses

(1) Food

(2) Biofuel

(3) Animal (and human) health

(4) Plant health

(5) Soap

(6) Natural colour dye

(7) Plants used for fishing

Comment. The plant species used for fishing (column 7) should be carefully considered for crop protection.

An exploration method is being elaborated to identify local plants to solve locally current or new sanitary issues (Keip et al., *2019).*

Perspectives

- Knowledge management reaching beyond the disciplinary boundaries of plant health will facilitate development of the transdisciplinarity advocated by the One Health approach.

References

ADAPPT (2017): http://projects.nri.org/adappt/

OPTIONs (2017): http://projects.nri.org/options/9-about-the-project

KEIP P. *et al.* 2019. Effects of input data formalisation in Relational Concept Analysis for a data model with a ternary relation. 15th International Conference on Formal Concept Analysis 2019. Lecture Notes in Computer Science 11511, Springer, 191-207.

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